

**WHAT IS CLAIMED IS:**

- (1) A multi-component environmentally responsive polymeric system, comprising at least two environmentally responsive polymeric components capable of undergoing a transition that results in a sharp increase in viscosity in response to a change in temperature at a predetermined body site, wherein said at least two components display different reverse thermal gelation behavior in the human body.
- (2) The multi-component responsive polymeric system of claim 1, wherein said increase in viscosity takes place when the system is heated up from a lower temperature to body temperature.
- (3) The multi-component responsive polymeric system of claim 1, wherein said responsive polymeric system displays an initial sharp increase in viscosity at insertion time, followed by additional changes in viscosity *in situ*, as a function of time.
- (4) The multi-component responsive polymeric system of claim 1, wherein said responsive polymeric system comprises at least one biodegradable responsive component.
- (5) The multi-component responsive polymeric system of claim 1, wherein each of said components is comprised of the same polymer and said components are present in different concentrations or states and as a result of said different concentrations or states display different reverse thermal gelation behavior.
- (6) The multi-component responsive polymeric system of claim 1, adapted for insertion into the human body, wherein at least one of said components is in a water solution form at the time of insertion.
- (7) The multi-component responsive polymeric system of claim 1, adapted for insertion into the human body wherein each responsive polymeric component is in a water solution form at the time of insertion.
- (8) The multi-component responsive polymeric system of claim 1, adapted for insertion into the human body, wherein at least one of said components is in a solid form at the time of insertion.
- (9) The multi-component responsive polymeric system of claim 6, wherein said at least one component present at the time of insertion in a water solution form is adapted to generate a continuous gel phase or independent or interconnected domains of various sizes, shapes and spatial orientations within the system at a predetermined body site,

all of these characteristics being able to change *in situ* over time affecting, therefore, the properties of the whole system.

(10) The multi-component responsive polymeric system of claim 8, wherein said at least one solid responsive polymeric component is a solid appearing in a diversity of shapes, sizes and geometries selected from a group consisting of spheres, particles, capsules, fibers, ribbons, films, meshes, fabrics, non-woven structures, foams, honey-comb structures, porous structures, and combinations thereof, each of them having the possibility of being solid, porous, hollow, and/or combinations thereof wherein said at least one solid component comprises at least one reverse thermo-responsive polymer and wherein said solid components are engineered so that a diversity of spatial arrays are obtained, dispersed homogeneously or heterogeneously, isotropically or anisotropically within the system, generating macro, micro or nanoscopic independent or interconnected domains within the system

(11) The multi-component responsive polymeric system of claim 1, wherein each of said responsive components is selected from a group consisting poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide) (PEO-PPO-PEO) triblocks, random or alternating reverse thermo-responsive PEO-PPO block copolymers, N-alkyl substituted acrylamides, cellulose derivatives and combinations thereof.

(12) The multi-component responsive polymeric system of claim 1, wherein said responsive component is selected from a group consisting of a polyoxyalkylene polymer, a block copolymer comprising polyethylene oxide (PEO) and polypropylene oxide (PPO) selected from a group consisting of a diblock, a triblock or a multiblock, a segmented block copolymer comprising polyethylene oxide (PEO) and polypropylene oxide (PPO) chains, wherein said PEO and PPO chains are connected *via* a chain extender, a poly(alkyl-co-oxyalkylene) copolymer having the formula  $R-(OCH_2CH)_n-OH$ , where R is an hydrophobic monofunctional segment selected from a group consisting of poly(tetramethylene glycol), poly(caprolactone), poly(lactic acid), poly(siloxane) and combinations thereof, a poly(alkyl-co-oxyalkylene) copolymer having the formula  $[-R'-(OCH_2CH)_n-O]_pH$ , where R' is a bifunctional or multifunctional hydrophobic segment, a poly(N-alkyl substituted acrylamide)s, cellulose and cellulose derivatives and combinations thereof.

- (13) The multi-component responsive polymeric system of claim 1, wherein said responsive polymeric system comprises at least two different environmentally responsive polymeric components.
- (14) The multi-component responsive polymeric system of claim 1, wherein said responsive polymeric system further comprises other polymers that are responsive to other stimuli selected from a group consisting of pH, ionic strength, electric and magnetic fields, ultrasound radiation, fluids and biological species and combinations thereof.
- (15) The multi-component responsive polymeric system of claim 1, wherein said responsive polymeric system comprising at least two environmentally responsive polymeric components comprises other non-responsive materials, organic, inorganic or biological, polymeric or not, that fulfill other chemical, physical, rheological, mechanical or biological roles.
- (16) The multi-component responsive polymeric system of claim 1, wherein at least one of said responsive polymeric components is crosslinked.
- (17) The responsive polymeric system of claim 16, wherein said crosslinked component is crosslinked in the body.
- (18) The responsive polymeric system of claim 16, wherein said crosslinking is temporary so that the system is able to essentially revert in the body, to its non-crosslinked state.
- (19) The responsive polymeric system of claim 1, wherein at least one of said responsive components contains a molecule or molecules, displaying biological activity, to be delivered into the body following a unimodal or multimodal release kinetics.
- (20) The responsive polymeric system of claim 1, wherein at least one of said responsive components contains organic or inorganic materials of biological source.
- (21) The responsive polymeric system of claim 1, wherein at least one of said responsive components contains living cells of at least one type.
- (22) The responsive polymeric system of claim 1, wherein at least one of said responsive components contains components of biological origin selected from a group consisting of elastin, a collagenous material, albumin, a fibrinous material, demineralized tissue or an acellular tissue matrix and combinations thereof.

(23) The multi-component responsive polymeric system of claim 1, whenever used as matrices for the unimodal or multimodal controlled release of biologically active agents, as sealants, as coatings and lubricants, as transient barriers for the prevention of post-surgical adhesions, in the area of Tissue Engineering and the field of Gene Therapy.

(24) The multi-component responsive polymeric system of claim 1, whenever used as both the matrix and the scaffold in the area of *ex vivo* as well as *in vivo* Tissue Engineering comprising one or more types of cells.

(26) The multi-component responsive polymeric system of claim 1, wherein said at least two components display different reverse thermal gelation behavior, displaying initially a defined Interface therebetween.

(26) The multi-component responsive polymeric system of claim 6, wherein at least one of said components that is in a water solution form at the time of insertion, polymerizes and/or crosslinks after insertion into the human body.

(27) The multi-component responsive polymeric system of claim 15, wherein said non-responsive material polymerizes and/or crosslinks after insertion into the human body.